

# PATENT ABSTRACTS OF JAPAN

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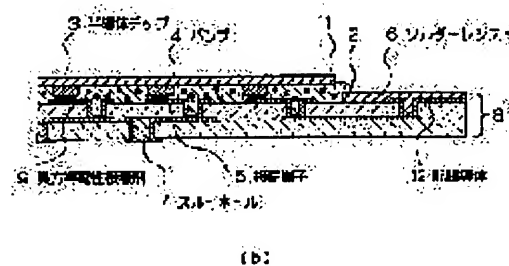
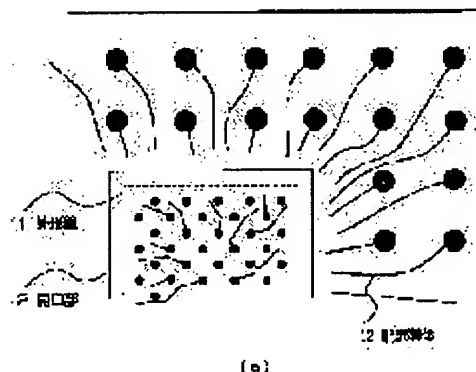
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## (54) SEMICONDUCTOR CHIP MOUNTING BOARD

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To improve connection reliability by providing a connecting terminal and wiring conductor for connecting with the bumps of a semiconductor chip on the surface of the board and not arranging the wiring conductor on the outline of the semiconductor chip to be mounted later.

**SOLUTION:** A wiring conductor 12 formed on the surface of a semiconductor chip mounting board 8 is not formed under the outline 1 of a semiconductor chip 3, and the opening 2 of solder resist 6 is formed larger than the outline 1 of the semiconductor chip 3. Then, a bump 4 is formed on the terminal electrode of the semiconductor chip 3, and an anisotropic conductive adhesive 9 is arranged between the semiconductor chip 3 and the semiconductor chip mounting board 8. The semiconductor chip 3 is faced down to be aligned with a connecting terminal 5 and is mounted on the semiconductor chip mounting board 8. Then, heat and pressure are applied to the workpiece, and the bump 4 and the connecting terminal 5 are electrically connected via the anisotropic conductive adhesive 9.



DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the substrate for semiconductor chip loading.

[0002]

[Description of the Prior Art] In recent years, the demand of the miniaturization of the circuit plate with which high performance-ization of electronic equipment consists of a patchboard and electronic parts from the first, and lightweight-izing is still severer with development of electronic equipment. It has so far evolved into the method which mounts a QFP package, a BGA package, etc. in the patchboard which established the circuit for connection in the front face from the method which mounted the DIP package, the PGA package, etc. in the patchboard which prepared the through hole. The dead space of a patchboard becomes [ latter one ] small, and high density assembly's being possible and the package itself depend this on a miniaturization and it high-performance-being easy toize. However, coexistence of not knowing, high-performance-izing of electronic equipment, the miniaturization of a circuit plate, and lightweight-izing has been a technical problem big even now about development of electronic equipment stopping.

[0003] The method of carrying a semiconductor chip in a direct patchboard as one of the solution approach of the, without carrying out packaging is capturing the spotlight. This approach is roughly divided into two by the method of junction of a semiconductor chip and a patchboard. The approach using wirebonding for which one has so far been used general-purpose with the technique of packaging, and another are the approaches of using bump connection. Generally the latter is called flip chip bonding, and since an electrode can be formed in the shape of an area array and the electrical property is [ the formation of many pins being easy and a signal pass path are short and ] good, it counts upon expansion of the spread of future.

[0004] The general flip-chip-bonding approach used the metal terminal which has the wettability arranged on the substrate of a pair of with the solder bump placed on the metal terminal which has the wettability of a semiconductor chip, and has connected the substrate with the semiconductor chip electrically by the reflow.

[0005]

[Problem(s) to be Solved by the Invention] By the way, although some structures of improving the mass-production nature of the substrate for carrying such a semiconductor chip were proposed in current, all had merits and demerits and had the technical problem that the high structure of mass-production nature had not been established.

[0006] This invention aims at offering the substrate for semiconductor chip loading which was excellent in mass-production nature after improving the dependability of connection.

[0007]

[Means for Solving the Problem] the connection terminal for the substrate for semiconductor chip loading of this invention being a substrate for semiconductor chip loading in which the semiconductor chip which has a terminal is carried with adhesives, and connecting with the front face with the bump of a semiconductor chip, and wiring -- a conductor -- having -- the wiring -- a conductor is characterized by not being arranged in the part of the visible outline of the semiconductor chip carried behind.

[0008] moreover, wiring for connecting the conductor which the substrate for semiconductor chip loading of this invention is a substrate for semiconductor chip loading in which the semiconductor chip which has a terminal is carried with adhesives, and only the connection terminal for connecting with the bump of a semiconductor chip was prepared in the front face, and was prepared in the field different from the connection terminal, or the substrate edge -- it is characterized by having a conductor.

[0009] It is desirable when also being able to establish the through hole for connection in such a substrate for semiconductor chip loading, and filling it up with the resin of stopgap in this through hole raises the through hole reinforcement to heat.

[0010]

[Embodiment of the Invention] wiring of this invention -- although a conductor may be wiring pulled out from the connection terminal and it may be other wiring -- wiring of this front face -- it is required not to arrange the conductor in the part of the visible outline of a semiconductor chip. the wiring -- it is desirable to have separated 100 micrometers or more from the visible outline of a semiconductor chip, the edge of a semiconductor chip and wiring may short-circuit that it is less than 100 micrometers at the time of loading, and the part by which the conductor is not arranged is not desirable.

[0011] Such a patchboard may consist of a through hole which connects for example, a connection terminal, the insulating layer supporting the connection terminal, the conductor on the back connected to the connection terminal, and a connection terminal and a conductor on the back, and the conductor may be a plastics lead loess chip carrier (henceforth PLCC) which is the patchboard connected to the half-segmented through hole formed in the substrate end face. Moreover, the patchboard which has the pad which has array spacing larger than array spacing of a connection terminal which replaced with the half-segmented through hole formed in this substrate end face, and was formed in the substrate rear face is sufficient, and if a solder ball is carried in this pad, it can be used as a ball grid array (henceforth BGA), and if the bump of solder metallurgy is formed, it can also be used as a flip chip.

[0012] moreover, a connection terminal, the insulating layer supporting the connection terminal, and the inner layer connected to the connection terminal -- a conductor, a connection terminal, and a inner layer -- from the Bahia hall which connects a conductor -- becoming -- the inner layer -- a conductor can be used also for PLCC which is connected to the half-segmented through hole formed in the substrate end face. a connection terminal, the insulating layer supporting the connection terminal, and the inner layer connected to the connection terminal -- a conductor, a connection terminal, and a inner layer -- from the Bahia hall which connects a conductor -- becoming -- the inner layer -- wiring which prepared the conductor in the same field as a connection terminal by the Bahia hall -- you may be the patchboard connected to the conductor. Moreover, you may be the patchboard connected to the through hole. And if the pin for connection is inserted in this through hole and it fixes with solder etc., it can also be used as a pin grid array (henceforth PGA).

[0013] Furthermore, it is a multilayer-interconnection plate, and it can be used also as the above PLCC, a flip chip, and BGA and PGA, and can also use combining such structures.

[0014] As for the aforementioned connection terminal, it is desirable to be supported by the substrate reinforced with the glass fabric, and the substrate with which the connection terminal is supported prepares a build up layer in the substrate reinforced with the glass fabric, and, as for a connection terminal, it is directly desirable that it is what is supported by the build up layer. As such a build up layer, the insulating layer reinforced with the nonwoven glass fabric is sufficient, and you may be the insulating layer reinforced with the aramid fiber.

[0015] In order to use the mixture of latency curing agents, such as an epoxy resin, an imidazole system, a hydrazide system and a boron-trifluoride-amine complex, sulfonium salt, amine imide, a salt of polyamine, and a dicyandiamide, and to ease the stress based on the coefficient-of-thermal-expansion difference of a circuit member as a resin constituent used for the adhesives on which the semiconductor chip which has the substrate for semiconductor chip loading and terminal of this invention is pasted up, the adhesion resin constituent of 100-1500MPa has a 40-degree C desirable storage modulus after adhesion.

[0016] For example, the adhesives which blended acrylic rubber with the mixture of latency curing agents, such as an epoxy resin, an imidazole system, a hydrazide system and a boron-trifluoride-amine complex, sulfonium salt, amine imide, a salt of polyamine, and a dicyandiamide, as a resin constituent of the adhesives which can acquire the good fluidity at the time of connection and high connection dependability so that the 40-degree C storage modulus after adhesion might be set to 100-1500MPa are raised. the storage modulus of the adhesive film hardened material which these resin constituents were dissolved in the solvent, and it applied to the film and sheet which carried out mold release processing on the front face, it heated below with the curing temperature of a curing agent, and the solvent was transpired, and was obtained -- for example, the product made from Rheology -- it can measure using LEO spectra DVE-4 (it pulls and is a temperature up at the mode, the frequency of 10Hz, and 5 degrees

C / min).

[0017] As acrylic rubber mixed in adhesives, the polymer or copolymer which used at least one of an acrylic acid, acrylic ester, methacrylic ester, or acrylonitrile as the monomer component is raised, and the copolymer system acrylic rubber containing the glycidyl acrylate which contains a glycidyl ether radical especially, or glycidyl methacrylate is used suitably. As for the molecular weight of these acrylic rubbers, 200,000 or more are desirable from the point which heightens the cohesive force of adhesives. As for the loadings in the adhesives of acrylic rubber, the 40-degree C storage modulus after adhesion exceeds 1500MPa(s) as it is less than [ 15wt% ]. Moreover, if it becomes more than 40wt%, although low elastic-modulus-ization can be attained, since the melt viscosity at the time of connection becomes high and expulsive [ of the melting adhesives of a connection electrode interface, or a connection electrode and an electric conduction particle interface ] falls, Since it becomes impossible to secure the electric flow between connection inter-electrode or a connection electrode and an electric conduction particle, as acrylic loadings, 15 - 40wt% is desirable.

[0018] Moreover, in order to make a film plasticity easier, thermoplastics, such as phenoxy resin, can also be blended with adhesives. Since an epoxy resin and structure are similar, and especially phenoxy resin has the descriptions, such as excelling in compatibility with an epoxy resin, and an adhesive property, it is desirable.

[0019] It liquefies by the dissolution or distribution to an organic solvent, the adhesion constituent which consists of the above-mentioned epoxy resin, acrylic rubber, phenoxy resin, and a latency curing agent in order to form such adhesives in the shape of a film is applied on a detachability base material, and it is carried out by removing a solvent below at the activity temperature of a curing agent, and is \*\*\*\*. The solvent used at this time is desirable in order for the partially aromatic solvent of an aromatic hydrocarbon system and oxygen containing to raise the solubility of an ingredient.

[0020] In these adhesives, an electric conduction particle can also be distributed in order to absorb height dispersion of the bump of a semiconductor chip, or a circuit electrode, and to give anisotropic conductivity positively. Such electric conduction particles are the metal particles which formed thin films, such as gold and palladium, in metal particles or these metal-particles front faces, such as Au, nickel, Ag, Cu, W, and solder, by plating or vacuum evaporatio, and the electric conduction particle which prepared conductive layers, such as nickel, Cu, Au, and solder, in the spherical karyomitome of macromolecules, such as polystyrene, can be used for them. It needs to be smaller than the minimum spacing of the electrode of a substrate, when dispersion is in the height of an electrode, it is desirable that it is larger than the dispersion, and the range of particle size which is 1 micrometer - 10 micrometers is desirable. Moreover, the electric conduction particle weight distributed by adhesives is 0.1 to 30 volume %, and is 0.1 to 20 volume % preferably. As such anisotropic conductive adhesives, a commercial thing has a flip tuck (the Hitachi Chemical Co., Ltd. make, trade name).

[0021] Moreover, as for the resin used when filling up through HORU with resin, it is desirable that it is the resin constituent which consists of polyamidoimide resin and a thermosetting component. The aromatic series diimide carboxylic acid which, the diamine which has three or more aromatic series rings, and an anhydrous TORIMETTO acid are made to react to this polyamidoimide resin, and is obtained, The aromatic series polyamidoimide resin which aromatic series diisocyanate is made to react and is obtained, As an aromatic series diimide carboxylic acid, or a 2 and 2-bis[4-{4-(5-hydroxy carbonyl -1, 3-dione-isoindolino) phenoxy} phenyl] propane, It is desirable to use the aromatic series polyamidoimide resin which 4 and 4'-diphenylmethane diisocyanate is made to react and is obtained as aromatic series diisocyanate.

[0022] In the diamine which has three or more aromatic series rings, a 2 and 2-bis[4-(4-amino phenoxy) phenyl] propane, A bis[4-(3-amino phenoxy) phenyl] sulfone, a bis[4-(4-amino phenoxy) phenyl] sulfone, 2 and 2-bis[4-(4-amino phenoxy) phenyl] hexafluoropropane, A bis[4-(4-amino phenoxy) phenyl] methane, 4, and 4-bis(4-amino phenoxy) biphenyl, The bis[4-(4-amino phenoxy) phenyl] ether, a bis[4-(4-amino phenoxy) phenyl] ketone, It is independent or 1, 3-bis(4-amino phenoxy) benzene, 1, and 4-bis(4-amino phenoxy) benzene etc. can be used combining these.

[0023] Moreover, it is independent, or 4 and 4'-diphenylmethane diisocyanate, 2, 4-tolylene

diisocyanate, 2, 6-tolylene diisocyanate, naphthalene -1, 5-diisocyanate, 2, and 4-tolylene dimer etc. can be combined and used for aromatic series diisocyanate.

[0024] Moreover, as for a thermosetting component, it is desirable that they are an epoxy resin, its curing agent, or a hardening accelerator, and as long as the epoxy resin has two or more glycidyl groups, what kind of thing is sufficient as it, and with [ a glycidyl group ] three [ or more ], it is still more desirable. At a room temperature, this epoxy resin may be liquefied or a solid is sufficient as it. As a commercial thing, YDF170 of bisphenol female molds, such as DER(s) [ , such as Ep815 and Ep828 (oil-ized shell epoxy incorporated company make, trade name), ]337 (the Dow Chemical Industries make, trade name), such as YD128, YD8125, etc. of the bisphenol A mold (the Tohto Kasei Industries make, trade name), YDF2004 grade (the Tohto Kasei Industries make, trade name), etc. are mentioned as a liquefied epoxy resin. Moreover, as a solid epoxy resin, DER667, DEN438 (the Dow Chemical Industries make, trade name), EOCN1020, etc., such as ESA019, ESCN195, etc., such as Ep1001 and Ep1010, such as YD907, YDCN704S, and YDPN172 (all are the Tohto Kasei Industries make and a trade name), and Ep180S70 (oil-ized shell epoxy incorporated company make, trade name), (the Sumitomo Chemical Co., Ltd. make, trade name), (the Nippon Kayaku make, trade name) are mentioned. Furthermore, in order to improve fire retardancy, a bromination epoxy resin may be used, for example, ESB(s)400 (the Sumitomo Chemical Co., Ltd. make, trade name), such as Ep(s)5050 (oil-ized shell epoxy incorporated company make, trade name), such as YDB400 (the Tohto Kasei Industries make, trade name), etc. are mentioned as a commercial thing. Moreover, although these may be used independently, they may choose two or more epoxy resins if needed.

[0025] As the curing agent or hardening accelerator of an epoxy resin, amines, imidazole derivatives, polyfunctional phenols, an acid anhydride, and isocyanates can be used. As amines, as imidazole derivatives, there are a dicyandiamide, diamino diphenylmethane, guanylurea, etc., there are an alkylation imidazole, benzimidazole, etc., a hydroquinone, resorcinol, bisphenol A and its halogenated compound, the novolak that is a condensate with an aldehyde, resol resin, etc. are in this further, and there are phthalic anhydride, hexahydro phthalic anhydride, benzophenone tetracarboxylic acid, etc. as an acid anhydride as polyfunctional phenols. As isocyanates, there are tolylene diisocyanate, isophorone diisocyanate, etc. and what carried out the mask of this isocyanate by phenols etc. may be used.

[0026] In the case of amines, the complement of these curing agents has the desirable amount to which the equivalent of the active hydrogen of an amine and the weight per epoxy equivalent of an epoxy resin become almost equal. For example, in the case of the 1st class amine, 0.5Eq of hydrogen is required for the 1st class amine of this to those with two, and 1Eq of epoxy resins, and, 1Eq in the case of secondary amine, it is required. Next, in the case of imidazole derivatives, it does not become equivalent ratio with active hydrogen simply, but it is [ 1 - 10 weight section ] experientially necessary to the epoxy resin 100 weight section. In the case of polyfunctional phenols or an acid anhydride, 0.8-1.2Eq is required to 1Eq of epoxy resins. In order to react to both polyamidoimide resin and an epoxy resin, 0.8-1.2Eq of cases of isocyanates is required to each 1Eq. Although these curing agents or hardening accelerators may be used independently, they may choose two or more curing agents or hardening accelerators if needed.

[0027] Moreover, compatibility will fall and the weight ratio of polyamidoimide resin and a thermosetting component will be gelled at the time of stirring, if the property of the polyamidoimide resin [ it is desirable that it is the range of the 10 - 150 weight section, and the coefficient of linear expansion from a glass transition point to 350 degrees C is large in their being under 10 weight sections, and ] that the storage modulus in 300 degrees C is low appears a thermosetting component as it is and the 150 weight sections are exceeded to the polyamidoimide resin 100 weight section.

[0028]

[Example]

MCL-E -67 (the Hitachi Chemical Co., Ltd. make --) which is a double-sided copper-clad laminate with a thickness of 0.8mm which made copper foil of 118 micrometers of examples rival to both sides the L-59 plating liquid (the Hitachi Chemical Co., Ltd. make --) which the hole used as a through hole 7 is made in a trade name, and is non-electrolytic copper plating liquid It is immersed in a trade name at 70 degrees C of solution temperature for 8 hours, deposit 15-micrometer plating copper, and etching

removal of the unnecessary copper is carried out alternatively. The through hole 7 was filled up with resin, the solder resist 6 was formed by silk screen print processes, and the substrate 8 for semiconductor chip loading which has a through hole was created. The resin with which it was filled up at this time was produced as follows. with [ which connected the reflux condenser ] a cock -- to the 1l. separable flask equipped with the 25ml aquametry receiver, the thermometer, and the agitator, it considered as the diamine which has three or more aromatic series rings, and NMP(N-methyl-2-pyrrolidone)716g was taught as a solvent, and 2 and 2-screw-[4-(4-amino phenoxy) phenyl] propane 123.2g (0.3 mols) and 115.3g (0.6 mols) of trimellitic anhydride were agitated at 80 degrees C for 30 minutes. And after supplying toluene 143g as water and aromatic hydrocarbon in which azeotropy is possible, temperature was raised and it was made to flow back at about 160 degrees C for 2 hours. It checked that the aquametry receiver is covered with about 10.8ml or more of water, and that the distillate of water was no longer seen, and temperature was raised to about 190 degrees C, removing a distillate collected on the aquametry receiver, and toluene was removed. Then, the solution was returned to the room temperature, 4 and 4'-diphenylmethane diisocyanate 75.1g (0.3 mols) was supplied as aromatic series diisocyanate, and it was made to react at 190 degrees C for 2 hours. The NMP solution resin of aromatic series polyamidoimide resin was obtained after reaction termination. An epoxy resin and phenol resin were added to the above-mentioned aromatic series polyamidoimide resin as a thermosetting component, and it agitated in ordinary temperature for about 1 hour, and considered as the resin constituent. # after hardening for 60 minutes at 160 degrees C with an electric heat drier after stopgap With the belt sander grinder T26MW mold (the Kikukawa Iron Works make, trade name) equipped with the abrasive cloth of 600, the surplus stopgap resin on the front face of a substrate was removed. It forms more greatly than the visible outline 1 of a semiconductor chip. this substrate 8 for semiconductor chip loading being the same as the visible outline 1 of a semiconductor chip, or the opening 2 of a solder resist 6, as shown in drawing 1 (a) As shown in drawing 1 (b), a bump 4 is formed in the terminal electrode of a semiconductor chip 3 with plating. furthermore, the flip tuck (the Hitachi Chemical Co., Ltd. make --) which is the anisotropic conductive adhesives 9 A trade name is arranged between the substrate 8 for semiconductor chip loading, and a semiconductor chip 3. Place said semiconductor chip 3 upside down, and alignment is performed for the connection terminal 5 on the substrate 8 for semiconductor chip loading. 180 degrees C after laying a semiconductor chip on the substrate 8 for semiconductor chip loading, The connection terminal 5 of the substrate 8 for semiconductor chip loading was electrically connected through the anisotropic conductive adhesives 9 with the bump 4 of a semiconductor chip 3 by heating and pressurizing from the chip upper part on 30g / bump, and the conditions for 20 seconds. Connection was completed by the approach of being flexible simple and very stably [ substrate / 8 / a semiconductor chip 3 and / for semiconductor chip loading ] as mentioned above. Furthermore, there was no poor formation of the solder resist 6 formed in the chip loading side of this substrate 8 for semiconductor chip loading, and the connection dependability after semiconductor chip 3 loading was good. Moreover, even if it floated the solder thermal resistance of a through hole on 260-degree C melting solder for 1 minute, neither generating of a through hole void nor exfoliation with base material resin was seen.

[0029] The substrate 8 for semiconductor chip loading was produced like example 2 example 1, and as shown in drawing 2 (a), the opening 2 of a solder resist 6 was formed smaller than the visible outline 1 of a semiconductor chip 3. And as shown in drawing 2 (b), melting of the tip of a golden wire is carried out to the terminal electrode of a semiconductor chip 3 on a torch etc. After forming a golden ball and sticking this ball by pressure on an electrode pad, the bump 4 who cuts a wire and is obtained is formed. furthermore, the flip tuck (the Hitachi Chemical Co., Ltd. make --) which is the anisotropic conductive adhesives 9 A trade name is arranged between the substrate 8 for semiconductor chip loading, and a semiconductor chip 3. Place said semiconductor chip 3 upside down, and alignment is performed for the connection terminal 5 on the substrate 8 for semiconductor chip loading. 180 degrees C after laying a semiconductor chip 3 on the substrate 8 for semiconductor chip loading, Since the connection terminal 5 of the substrate 8 for semiconductor chip loading was electrically connected through electroconductive glue 9 with the bump 4 of a semiconductor chip 3 by heating and pressurizing from the chip upper part



on 30g / bump, and the conditions for 20 seconds, it is made to be. Connection was able to do simple and very stably the semiconductor chip 3 and the substrate 8 for semiconductor chip loading by the approach of being flexible. Furthermore, there was no poor formation of the solder resist 6 formed in the chip loading side of the substrate 8 for semiconductor chip loading, and the connection dependability after semiconductor chip loading was good. Moreover, even if it floated the solder thermal resistance of a through hole on 260-degree C melting solder for 1 minute, neither generating of a through hole void nor exfoliation with base material resin was seen.

[0030] wiring formed in the front face of the substrate 8 for semiconductor chip loading as the substrate 8 for semiconductor chip loading was produced like example 3 example 1 and it was shown in drawing 3 (a) -- the conductor 12 was not formed but formed greatly 100 micrometers of openings 2 of a solder resist 6 in the bottom of the visible outline 1 of a chip rather than the visible outline 1 of a semiconductor chip 3. And as shown in drawing 3 (b), a bump 4 is formed in the terminal electrode of a semiconductor chip 3 with plating. furthermore -- as the anisotropic conductive adhesives 9 -- a flip tuck (the Hitachi Chemical Co., Ltd. make --) A trade name is arranged between the substrate 8 for semiconductor chip loading, and a semiconductor chip 3. Place said semiconductor chip 3 upside down, and alignment is performed for the connection terminal 5 on the substrate 8 for semiconductor chip loading. 180 degrees C after laying a semiconductor chip 3 on the substrate 8 for semiconductor chip loading, The connection terminal 5 of the substrate 8 for semiconductor chip mounting was electrically connected through the anisotropic conductive adhesives 9 with the bump 4 of a semiconductor chip 3 by heating and pressurizing from the chip upper part on 30g / bump, and the conditions for 20 seconds. Connection was completed by the approach of being flexible simple and very stably [ substrate / 8 / a semiconductor chip 3 and / for semiconductor chip loading ] as mentioned above. Furthermore, there was no poor formation of the solder resist 6 formed in the chip loading side of this substrate 8 for semiconductor chip mounting, and the connection dependability after semiconductor chip loading was good. Moreover, even if it floated the solder thermal resistance of a through hole on 260-degree C melting solder for 1 minute, neither generating of a through hole void nor exfoliation with base material resin was seen.

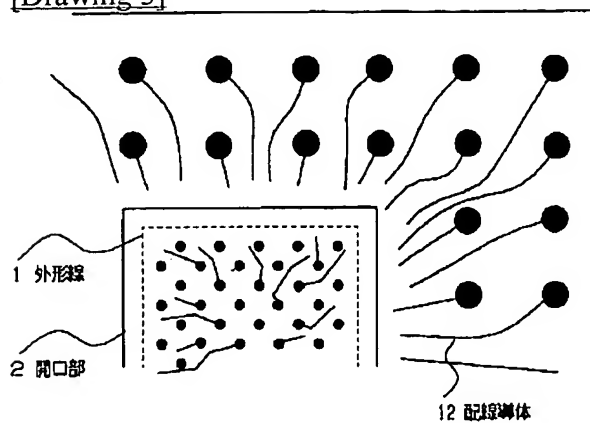
[0031]

[Effect of the Invention] As explained above, the substrate for semiconductor chip loading which was excellent in mass-production nature after improving the dependability of connection can be offered by this invention.

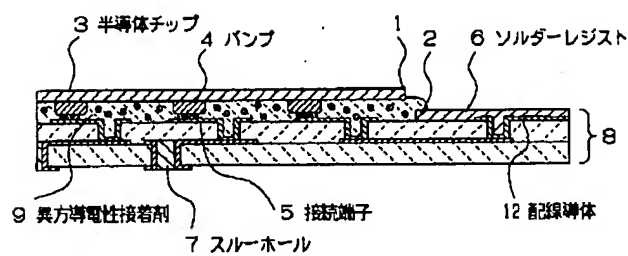




[Drawing 3]



(a)



(b)